

BELLCOMM, INC.

1100 Seventeenth Street, N.W. Washington, D. C. 20036

SUBJECT: Trip Report - ATM H α Presentation
and Filters Review Meeting at
Rye Canon Case - 630

DATE: March 19, 1968

FROM: A. N. de Gaston

ABSTRACT

The ATM H α presentation and filters review meeting was held at the Lockheed Solar Observatory, February 26 and 27, 1968. The present H α interference filter state of the art was reported on. Specifications for these filters and the HCO and MSFC H α telescopes were also set.

(NASA-CR-94886) ATM H ALPHA PRESENTATION
AND FILTERS REVIEW MEETING AT RYE CANON
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MEMORANDUM FOR FILE

The author attended a meeting to review the ATM H_α displays and the up to date merits of H_α interference filters. The meeting was held at the Lockheed Solar Observatory, Rye Canon, California, February 27 and 28, 1968. The expected report by Lockheed was held up due to the filter non-uniformity problem and is now to be delivered in approximately three months.

Dr. Reeves of Harvard College Observatory (HCO) gave a presentation which included a discussion of the present interference filter state of the art and the tentative goals of the H_α telescopes under the HCO and MSFC sponsorship. Three companies have been involved in the filter competition - Spectra Lab (SL), Thin Films (TF), and very lately, Perkin Elmer (PE). However, the competition has narrowed to SL and PE.

The SL filter consists of a thin mica primary element stretched on a quartz ring upon which appropriate spacing layers are affixed. The PE filter is more complex and heavy consisting of a coated polished glass or quartz thin sheet attached to a coated spacer which assembly is then mounted on a glass (or quartz) block. TF filters consist of organic materials deposited from solution upon a suitable substrate to form a thin interference film. Bandpass peak drift in Angstroms with temperature change has been measured with the following results.

SL	1Å/14.5°F
PE	1Å/45°F (fused silica base)
TF	1Å/8°F

It is apparent that SL and PE filters are more temperature stable. The PE is so stable that it is at a disadvantage for "tuning in" different areas of the H_α line.

The filters suffer from a non-uniformity in thickness over their transmitting areas which widens the bandpass. Furthermore, light not normally incident travels a different length and optical path than that normally incident. Tests made in parallel (collimated) light for a SL filter gave these results:

$\Delta\lambda$ (\AA)	θ (deg. from normal)
.4	1°
2.0	2°
2.0	2°
3.7	3°

$\Delta\lambda$ is the change of the optical path length in \AA due to not traveling perpendicularly between faces. Thus, there is an effective increase in bandwidth for a bundle of non-parallel rays. Since $\Delta\lambda \sim (\theta)^2$ where n is the index of refraction, the effect is more pronounced in the SL filter with $n = 1.2$ than the PE filter with $n = 1.46$.

Apparently there is no change in bandpass form or central peak with age for SL filters. Extrapolation from physical properties predicts the same for PE filters. However, the TF filters do show an aging effect. This combination with poor thermal performance has eliminated TF from the competition.

Since non-uniformity across filter disks has been about twice the desired bandwidths, Dr. Reeves has asked SL and PE for quotations of

$$\lambda_0 \sim \pm .05\text{\AA}$$

$$\text{Transmission} \sim \pm 5\%$$

The specifications on the MSFC and HCO H₂ telescopes are summarized in the attached table. In the table, Δt refers to film exposure times.

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	<u>APERTURE</u>	<u>FIELD OF VIEW</u>	<u>$\Delta\lambda$</u>	<u>Δt</u>	<u>VIDEO</u>	<u>COMMENTS</u>
HCO SLIT-JAW	8cm, f/12.5	17' video 20' photo	.5Å (COLLIMATED)	60 secs. 120 secs.	SEC TUBE	30"x30" HOLE AT SLIT POSITION, 3"/VIDEO LINE RESOLUTION, 2" PHOTO RESOLUTION
H _α #1 (HCO)	6-1/2 in, f/30	35'x35' to 7' x 7'	.5Å (TELECENTRIC)	~.1 to .02 secs.	SEC TUBE	DIFFRACTION 1", RESOLUTION/TV LINE VARIES 6" TO 1.2" SO375 FILM TO BE USED
H _α #2 (MSFC)	6-1/2 in, f/16.5	"	.9-1.2Å ^o (TELECENTRIC)		VIDICON	NO PHOTO

Table 1.

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From: A. N. de Gaston

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